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Macroscopic Einstein equations to second order in the interaction constant

Zakharov A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The present paper is a direct continuation of an earlier paper [JETP 83, 1 (1996)] devoted to the derivation of the macroscopic Einstein equations to within terms of second order in the interaction constant. Ensemble averaging of the microscopic Einstein equations and the Liouville equation for the random functions leads to a closed system of macroscopic Einstein equations and kinetic equations for one-particle distribution functions. The macroscopic Einstein equations differ from the classical equations in that their left-hand side contains additional terms due to particle interaction. The terms are traceless tensors with zero divergence. An explicit covariant expression for these terms is given in the form of momentum-space integrals of expressions dependent on one-particle distribution functions of the interacting particles of the medium. The given expressions are proportional to the cube of the Einstein constant and the square of the particle number density. The latter relationship implies that interaction effects manifest themselves in systems of very high density (the universe in the early stages of its evolution, dense objects close to gravitational collapse, etc.).